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ABSTRACT

A summary of the workshop convened in May 1971 in Salvador, Bahia, Brazil by the Council on Higher Education in the American Republics to assess current applications of communications technology for the improvement of educational systems in Latin America is given in this document. Against a background which includes: 1) technological asymmetry in which hardware development races ahead of software development and in which technology is not fully integrated into the overall educational matrix; and 2) an educational crisis in the developing world due to scarce resources, rising community expectations, and skyrocketing enrollments, the question of what the new technology has to offer is posed. The report treats some challenges of modern education, the concept of educational technology and some approaches to it, and the various media forms. It then discusses educational technology in action, giving examples from El Salvador, Niger, American Samoa, the Ivory Coast, Great Britain, Spain and Brazil. It closes with a discussion of some issues related to technological implementation and of the prospects for the future. (PB)

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COMMUNICATIONS TECHNOLOGY and the CRISIS IN EDUCATION

A Report on the Bahia Workshop

CHEAR

COUNCIL ON HIGHER EDUCATION IN THE AMERICAN REPUBLICS
Institute of International Education
809 United Nations Plaza, New York, N. Y. 10017

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The Council on Higher Education in the American Republics (CHEAR) is a private, non-profit educational organization established in 1958 to provide a forum for the regular exchange of ideas and information among university leaders from Latin America and the United States. CHEAR's basic objective is the improvement of higher education in the Americas. Through its program of conferences, workshops, seminars, and publications CHEAR seeks to focus attention on major problems of university teaching, research and administration and to stimulate specific projects directed toward their solution.

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Communications Technology and The Crisis in Education

A Report on the Bahia Workshop

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INTRODUCTION

Recent spectacular advances in the areas of technology and communications have produced a range of new devices, media, facilities, and organizational methods which can be used to assist in, and hopefully to improve, instruction in schools and universities. One of the most striking developments on the educational scene in the United States since the end of World War II has been the rapid, and in some cases the uncritical, acceptance of these new techniques and devices as solutions to the problems of mass education. The gamut has been run from audio-visual aids through educational television, teaching machines and the use of the computer as an instructional tool. One major effect of this has been the formation of the so-called "education industry," consisting of major electronics and computer companies such as IBM, RCA, General Electric and Westinghouse which proceeded to acquire textbook and scientific publishing companies and to form new corporate units in a bid to capture the education market. It was the vision of these new units that problems of mass education could be solved by a computer-based systems approach which would merge the "hardware" and the "software" into a workable technology of instruction. Unfortunately, the promise has not been fulfilled and general disillusionment has set in.

Among the problems which came to the fore were that the software needed to make the machines work was often of low quality, the teachers did not know how to use the equipment, the machines themselves were prone to frequent and unpredictable breakdowns, the students found them unexciting if not actually boring, and educational planners tended in practice to view the new technology as peripheral and *ad hoc*. Moreover, the constraint of money and the absence of a sophisticated appreciation and innovative educational organization operated against the success of the experiments. In other words, educational budgets were not prepared with the new technology in mind, teachers were not trained to use the new media, technicians were not available to repair the equipment, and above all, educational administrators did not follow through on the development of an educational system in which the new technology would form an integral part.

The lessons to be learned from the American experience with the use of the new technology are that it cannot be regarded as a panacea for the quick solution of complicated problems nor can it easily be grafted onto a traditional educational program. Dr. Seth Spaulding of UNESCO has provided a useful conception of educational technology: "A true technology of education includes the entire process of the setting of goals, the continuous renewal of curriculum, the trying out of alternate strategies and materials, the evaluation of the system as a whole and the resetting of goals as new information on the effect of the system is known. However, educational technology is often identified with the various devices and processes which make possible the recording, storage, manipulation, retrieval, transmission and display of data, information, and printed and

photographic material with an efficiency and speed unheard of even ten years ago. If these capabilities are considered as part of a broad curriculum research and development design, they have tremendous potential in education."

It is clear that some basic questions have to be asked, the most important of which is: "education for what?" It is essential that the problems facing an educational system first be defined as precisely as possible, and only after such definition can solutions to the problems be examined and tested. The most serious error is to focus on the devices themselves and to ignore the goals and objectives of the system in which they are to be introduced.

Some observers have noted that the new instructional technology is inappropriate for introduction into the educational systems of the developing countries, largely because of the high cost involved in the face of limited resources. Other experts have argued with equal persuasiveness that developing countries cannot afford *not* to invest in innovative methods to improve instruction. With these issues in mind, the Council on Higher Education in the American Republics decided to convene a Workshop to assess current applications of communication technology for the improvement of educational systems in Latin America. Some forty persons participated in the Workshop, including government officials, university presidents and deans, educators, specialists and experts from Latin America, the United States and Europe. The Workshop met during the last week in May 1971 in Salvador, Bahia, Brazil, in quarters provided by the Federal University of Bahia through the generosity of its Rector, Dr. Roberto Santos, who is a member of the CHEAR Executive Board and was a participant in the Workshop.

In common with most parts of the developing world, the Latin American region is up against an education problem of crisis dimensions, compounded quantitatively of severe shortages in money, staff and physical resources; rising community expectations; and, above all, overwhelming increases in student enrollments. Other facets of the problem, though less easy to measure, are nonetheless real: heavy social costs flowing from the absence of meaningful linkages among educational levels; inefficient and wasteful use of human resources; antiquated methods of instruction; and serious disparities between educational output and national needs.

In the face of a problem of this scope, what does the new technology have to offer toward a solution, or, more realistically, an amelioration? This was the basic question put to the Workshop. The answer was sought indirectly. What is educational technology? How has it been used to date? What results have been attained? What problems have been encountered? What are its strengths and weaknesses in specific situations? What costs are involved? Do the benefits justify the costs? If a school or a system or a national ministry plans to introduce technology, how should it proceed? What alternatives are available? How can an intelligent selection be made? What research is available? Where can the data be found? Is there a decision-making model which can suggest guidelines?

The Workshop was fortunate in having as its principal resource spe-

cialist Dr. Sidney Tickton of the Academy of Educational Development, who prepared the basic background paper (see Appendix I). Major presentations were made by Dr. Walter Beneke, Minister of Education, El Salvador, on the Salvador ETV program; Dr. Raymond Johnson of International Business Machines, on computer technology; Dr. Fernando de Mendonça of Brazil, on the Brazilian Educational Satellite Program; Dr. Eric Prabhakar of UNESCO, Paris, on the Spanish Educational Reform Program; Mr. Michael Melnik of the University of Massachusetts, on micro-teaching; and Professor Kevin Keohane of the University of London on the Open University in the United Kingdom. To each of these individuals, as well as to the Workshop participants, CHEAR expresses its sincere thanks. We also acknowledge with gratitude financial support provided by the Inter-American Development Bank and the United States Agency for International Development. Representatives of both these organizations took an active part in our deliberations.

It was my privilege to serve as Chairman of the Workshop, and my responsibility to prepare the final report. Thanks to the able rapporteurial assistance of Edi Madalena Fracasso and Tarcisio Della Senta, Brazilians and doctoral candidates at the Center for Studies in Education and Development, Harvard University, this task was far easier than it might otherwise have been. In spite of my effort to have the report reflect the collective contribution of the participants, mistakes in fact and misrepresentations of viewpoint may have crept in unnoticed. If so, the responsibility is mine.

James F. Tierney
New York, New York
1971

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I

EDUCATIONAL PROBLEMS AND TECHNOLOGY

A. CHALLENGES OF MODERN EDUCATION

Most nations today, whatever their stage of economic and social development, are facing a general crisis in education. In the so-called developed societies old problems regain force and urgency and new demands bring additional strains to bear on the educational systems: the need for an education more relevant to the continuous change of modern life; an education more tailored to the peculiar capacities and aspirations of each individual; a more democratic education which can offer members of minority groups the richest sources of knowledge and culture usually reserved for the elites.

This general crisis in education manifests itself in different ways depending on the particular circumstances of each country. Some countries face the problem of a rapid increase in school-age population without enough schools to meet the increased needs. Others, with a scarce number of teachers and overcrowded classrooms are witnessing a lowering in the quality of education. There are countries that offer an adequate fundamental education, but lack the resources to provide for upper grades. In others, it is the management of the educational system that appears to be the fundamental problem: lack of coordination, lack of supervision and evaluation, rigidity of the system itself, making reform impossible without outside support.

These educational problems are ones which many national leaders realize cannot be solved by conventional means. Some have therefore turned their attention to newer, more radical solutions; one of them is the application of communications technology to education. Educational technology seems to offer a way out of an increasingly hopeless situation.

The purpose of the Bahia Workshop was to explore and evaluate the present uses of educational technology in various parts of the world. But before reporting on the discussions which developed around this topic we must first describe more fully wide-ranging the concept of educational technology, the varying approaches to its use and the role of the communications media in its application.

B. CONCEPT OF EDUCATIONAL TECHNOLOGY

In the Bahia Workshop two main definitions of educational technology emerged. The first one gives emphasis to the devices, the second to the

ends for which the devices are mere means. Dr. Sidney Tickton expressed these two positions as follows:

"Educational Technology can be defined in two ways: in its more usual sense, it means the media born from the communications revolution which can be used for instructional purposes, alone or in combination with the teacher, textbook and blackboard. These media include radio, television, films, overhead projectors, language laboratories, programmed instruction, computers and other items of "hardware" and "software" (to use the conventional jargon that distinguishes machines from programs).

"The second and more recent definition of educational technology goes beyond a preoccupation with any particular machine, medium or device. Too much emphasis placed on equipment as such has led to impoverished applications. In this sense, educational technology means a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research on human learning and communication, and employing a combination of human and non-human media to bring about more effective instruction. Though there have been only limited attempts to design instruction using such a systematic, comprehensive approach, there is reason to believe that this approach holds the key to the contribution technology can make to the advancement and improvement of education."

Educational technology and its uses present a wide variety of problems, and the Bahia Workshop discussed some of these questions from varying points of view: the nature and the uses of the different media; the conceptual considerations arising out of various approaches to the use of media in education; the political and cultural aspects involved in the fact that complicated media are used without adequate adaption to the peculiar conditions of the country; the engineering aspects involved in the designing, production and maintenance of media; the economic aspects involving cost of acquisition, operation and maintenance of the equipment.

In theory these dimensions of the problem can be analyzed separately. In real life, however, they are highly interrelated, and must be so viewed. The Bahia Workshop adopted a holistic approach, although the discussions centered mainly on the educational aspects. But linkages with other aspects such as economic, engineering and political were also noted.

C. APPROACHES TO EDUCATIONAL TECHNOLOGY

From the discussions and from Tickton's presentation it became clear that an evolution has taken place in the way technology has been viewed as an instrument of education. Three views have been successively held about educational technology: (1) technology as a substitute for the teacher; (2) technology as an aid to the teacher and (3) technology as an aid to the learner.

1) Some educators, administrators and businessmen see educational technology as a way to overcome many of the pitfalls of the teacher-blackboard-and chalk stage of education. For them, instructional technology represents in education something of the same dimension as the shift

that industry made from hand labor to mechanization. Their idea is that automation can also be adopted in the field of education. The substitution of labor force by the machine that occurred in industrial activities and other human activities make them believe that instructional technology can substitute for the teacher. Sophisticated devices, including complex "hardware" of computerized systems and teaching machines or less complex instruments of programmed instruction are thought of as being able to replace most of the teacher's activities.

2) A second approach focuses on educational technology as a help to the teacher. Most of the various technologies and electronic devices are used as aids to the classroom teacher. Colleges, universities and schools have been using television, film, computers and other devices as supporting material to the teacher's activities. Technology can help educators to base instruction more systematically on what is known about learning and communication, not only to guide the basic research, but also to provide strategies for applying research findings.

In addition, technology can help the teacher make better use of his time, by reducing the heavy burden of administrative tasks and by taking over some of the teacher's routine job of information transmission. Thus, the teacher is able to spend more time teaching, inspiring students to learn and encouraging them to apply newly acquired information to more intellectually demanding problems.

3) A more recent approach sees educational technology as a help to the learner. Here the emphasis is shifted from the teacher's activity to the needs of the student, who becomes the main center of technological attention, and this in turn opens up the possibility of many new ways of learning. Individual differences can be taken into account. The traditional standardization of what students learn, how they learn, when and at what pace, is no longer necessary. Different combinations of teacher, students, materials, space, time, and money make it possible to respond more to actual learning needs and less to administrative convenience.

Educational technology in this sense becomes a critical element in the educational system and in changing that system. It is no longer simply a teacher's aid, but an instrument to improve student learning. Introducing educational technology in this way could make a significant difference to teachers, to administrators, and principally to students. Today this emphasis on the students has become the most important and crucial point in the field of educational technology.

In the discussions, emphasis was given to this student-oriented approach; but most of the experiments presented to the Workshop were examples of the use of technology as an aid to the teacher. The problem is that the use of technology as an aid to students is very much dependent on the development of a comprehensive learning theory. Until there is a satisfactory answer to the question of how people learn many other questions will remain to be answered. These questions are recurrent in seminars about educational technology and they inevitably arose again in the Bahia Workshop:

1. What do the new communications technologies offer to education?

2. Can the new technologies help to solve the educational problems facing most countries around the world?

3. Can the new technologies help improve the curriculum, make education more responsive to individual students, reach more people and fill the gaps left by the shortage of trained teachers?

No simple answers to these questions were found. However, our investigations reveal some definite trends and important clues. They led us to believe that while educational technology is no instant cure for the crises facing education, it can, when properly used, (a) increase the efficiency and productivity of the educational process, (b) multiply the impact of the really effective teacher, and (c) thus improve learning. Whether technology can be cost effective for educational purposes is not so clear. More research and experimentation must be done.

The list of countries employing technology for various educational purposes is long. The list would cover all continents, both large and small countries, and rich and poor localities. However, only a few countries in the list build technology into their educational systems in a comprehensive way in order to improve the educational process substantially in a short time.

D. THE MEDIA

During the Bahia Workshop, a wide range of educational technologies were discussed. Little emphasis was given to already commonly used audio-visual devices and instructional materials for supporting teaching in conventional classrooms. Much greater emphasis was given to more recent and sophisticated media such as radio, TV, computer and satellites. It was again Tickton's paper that provided a brief description of these media, and this was added to the oral presentations of Johnson and Mendonça. Melnik described the theory and operation of micro-teaching.

1. RADIO

Radio, now in its fifth decade of use in formal and adult education, has nowhere yet been used as part of a systematic effort to effect educational change.

Radio, although lacking the dramatic appeal of television, has certain important practical advantages over television. It is cheaper, more widely available, much easier to use, and—thanks to the transistor and inexpensive methods of tape recording—much more flexible. This vast potential has yet to be tapped—its use to date, while worthwhile, has been largely supplementary.

Many developing countries where television is confined to a few major cities can reach outlying rural areas by radio with great ease and relatively little expense. By using support material such as printed texts and pictures, radio can be turned into an audiovisual (and thereby successful) medium. Radio used in conjunction with specially designed filmstrips ("radiovision") can provide audiovisual instruction at a fraction of the cost

of television. Adapting a mass medium like radio to individual educational needs means using it in combination with other modes — books, monitors, correspondence courses, discussion groups.

2. TELEVISION

Introduced more recently than radio or any of the older audiovisual media, educational television has had a significant impact on the educational systems of a few of the developing countries. Its record in the developed world is not particularly impressive; in the United States, for example, instructional television fills less than three percent of total classroom time in the elementary and secondary schools of the nation's sixteen largest cities. Of course, it is important not to overlook the *educative* effect of nonschool television, increasingly becoming the major source of information for citizens in some of the industrialized countries.

With the advent of cheaper videotape recorders, new distribution systems like satellites, cable television, videodiscs, television is proving to be a flexible technology with varied uses in education.

There is increasing interest in the medium as a way of overcoming the scarcity of teachers and school and, on a big scale, as an enabling agent for major educational reform.

3. COMPUTERS

In strong contrast to audiovisual aids, the computer has been little used for educational purposes in the developing world. In the technologically more advanced countries, the computer, with its unique capacity for data storage and retrieval, has been successfully used as a research tool and as an aid in school and college management. Indeed, computer managed instruction (CMI) has already begun to realize some of its tremendous potential for assisting educational administrators and managers, teachers, and students.

The computer, when properly programmed, will organize, synthesize, and present relevant information to help guide a wide range of administrative decisions, from those concerned with such logistical problems as adequate use of classroom space, class scheduling, and faculty requirements, to the larger more complex issues of optimizing learning effectiveness and efficiency, and making learning more individual. Successful use of this technique depends upon adequate programing, which in turn requires a detailed analysis of an educational system—its people, material, facilities and objectives. The computer uses these data to simulate or model the possible effects of various options, thus helping the decision maker to choose and use available resources as wisely as possible. Once a system is operating, the computer can analyze and help evaluate results as they are obtained, thereby providing the possibility of immediate revision and correction. The CMI system can also be made available to the student as a constant advisor, suggesting alternative learning strategies on the basis of the individual's past performance.

But the computer's showing in purely instructional areas (CAI: computer-assisted instruction) is clouded over with frustrations. To date, pro-

grams have been largely limited to pure drill and practice lessons: truly individualized programs have yet to be designed; the hardware and software are still in a primitive stage. Computer equipment has not been custom designed for education use, and its price ranges from high to astronomical. Enthusiasm for CAI stems from *potential* developments. Preliminary experiments indicate that, as an instructional tool, the computer offers a highly sophisticated machine for the display of programmed materials, and can be in its own right a strong incentive to creative thinking and learning.

4. SATELLITES

Recent studies suggest that communications satellites could, for large scale applications, be the most effective way of overcoming inadequate educational and communications systems and of providing high-quality education to people in remote and underdeveloped areas. A satellite offers to a large country or group of countries lacking adequate ground communications a system that can cover a geographic area of a million or more square kilometers. It can broadcast to an entire region or beam its presentation selectively to specific areas for particular users. It can reach isolated, mobile and dispersed populations with an ease and total cost comparable to that involved in teaching dense groupings of people. Unobstructed by mountains, rivers, and other geographical barriers, it offers easy access to regions that would be extremely difficult or very expensive to reach by ground systems. Furthermore, satellites can meet several purposes besides those of education: communications, geological and spacial research, etc.

Satellites, however, are not an educational device. They are only a more powerful and far-reaching means of communication giving support to TV and radio. Just as in television or radio, they are neither better nor worse than the quality of what is transmitted.

The success of educational use of satellites will inevitably depend on the content of the program aired, quality of teaching, indeed most of the components of educational systems.

The Workshop touched upon all these media, but most of the time the discussions centered on television. It is by far the most impressive current experiment in educational technology used either as part of integral school reform or to extend the reach of schooling or simply for enrichment, as will be shown later in this report.

5. MICROTEACHING

Microteaching is a teacher training method that uses a scaled-down technique in which the trainee teaches a small group of pupils for a short period. The lesson is on some topic in the trainee's field, but concentrates particularly on a specific teaching skill.

Microteaching combines several recording devices and group techniques to help the trainee acquire or improve his teaching skills. The practice teaching includes a variety of activities: explaining, demonstrat-

ing, recording, testing, evaluating. Skills such as fluency, gesture, interaction, movements, etc. require specific training. To improve these teaching skills microteaching proceeds as follows:

a) First, the specific skill to be trained or improved is chosen;

b) the trainee has the selected skill demonstrated to him either by a supervisor (live) or by film or video-tape;

c) next, the trainee teaches a brief lesson to use this skill. He usually teaches this lesson to three or four students. The supervisor views the lesson, and where possible the lesson is video-taped, although video-taping is not essential to microteaching;

d) the lesson lasts for four or five minutes. After the lesson, the supervisor distributes rating forms to the students and fills one in himself. What follow is a critique session centered on the performance of the skill. The evaluation forms and video-tape are used to help the trainee think of ways to improve his skills. At the end of this critique, the trainee prepares to teach again to a different set of three or four students, trying to improve his performance and bearing in mind the criticisms from the supervisor. At the end of the lesson, the same evaluation procedures are again followed.

II

EDUCATIONAL TECHNOLOGY IN ACTION

Most of the reports made at the Workshop about actual applications of educational technologies were about the use of TV. The only significant exception was a report on educational reform in Spain where Computer Assisted Instruction (CAI) was a major facet of the program.

Yet the reports covered a variety of situations. In some of them the technology was used as part of a fully integrated system for improving education (El Salvador, American Samoa, Brazil-SACI). Others were oriented towards solving a problem in a small part of the educational system (Anchieta Foundation) or on a regional basis (Niger).

The reports could also be classified according to the span of time in which the experiment had been in operation. Some of the experiments were ten years old, while others were much more recent, and some were merely projects on paper to be implemented at some future date.

It is still to early to judge in any final way the success or failure of the experiments reported on. Yet some of them offer indications that are very encouraging.

A. EL SALVADOR[1]

El Salvador is the smallest and most densely populated country of the Western Hemisphere. (It has 3,500,000 inhabitants for an area of 21,393 square kilometers).

Very poor in natural resources it does not have oil, minerals, hydroelectric potential, forests nor even new lands that could be used for agriculture. "This sour reality made us understand that El Salvador's population could either be the worst basis for a process of development if it were to continue illiterate or poorly educated, or its only potential resource if competenly prepared and trained."

During the sixties the educational situation in the country was very similar to that of other underdeveloped countries: a high percentage of illiterates (around 50 percent of the population), 30 percent of the school-age children out of school, high rates of drop-outs especially in the first grades of primary school. All these problems were compounded by an archaic bureaucratic system, corruption in the supervision services, political patronage in the appointments and promotions of teachers and administrative officials.

Moreover the accelerated rate of expansion in the primary schools (6 grades in the then existing system) promoted by the previous government was starting to put great pressure on the secondary schools and they were completely unprepared to meet the present and greater future demands for enrollment. The 69 normal schools of the country were continuing to pro-

[1]Based in the oral presentation made by Dr. Walter Beneke, Dr. Stanley Handleman and Dr. Sidney Tickton.

duce new primary school teachers in excess of the needs up to the point that in 1967 there were 4,000 unemployed teachers. All these problems needed an urgent and integrated solution.

A "ready made recipe" for the reorganization of the educational system which would effectively contribute to the solution of the social and economic problems of El Salvador was not available.

The people in the Government responsible for the educational system decided to use educational television as a catalytic agent to spur reform and innovation.

1. EARLY DEVELOPMENTS

The idea of using television as an aid to education in El Salvador started to take shape in 1961. At that time, Dr. Walter Beneke, the present Minister of Education, was Ambassador to Japan. He was impressed by the Japanese use of TV for education and felt that his country could profit greatly from this example. As a result of Dr. Beneke's intervention a Japanese mission was sent to El Salvador to assess the possibilities. The mission, in a preliminary finding, later reinforced by an extensive report, determined that El Salvador had ideal conditions for the use of instructional TV: a small territory, a concentration of population, almost total electrification, unity of language and educational system, and decision-making centralized in the Ministry of Education. In addition, El Salvador had a favorable geographical conformation that allowed the whole territory to be covered by TV transmission with the use of only one emission station and two relay-stations.

In 1964 the National Commission of Educational Television was created, charged with policy-making and planning responsibilities, while the Department of Educational TV at the Ministry was charged with executive responsibilities.

Up until 1967 TV was used as an instrument to solve one specific problem—expansion of the secondary school system. In 1967 with the help of UNESCO a training course for TV personnel was set up, and the first experimental courses were broadcast.

Another important event of this year was the offer of the United States, made at the Conference of Punta del Este (Alliance for Progress), to provide assistance to projects using educational TV. El Salvador through its elected president applied for this assistance. An AID Mission under the direction of Dr. Stanley Handleman was sent to El Salvador. Since then this mission has played an important part in helping the development of educational TV in El Salvador. Other international agencies such as the World Bank, UNESCO, UNICEF and the British and Japanese Governments have also provided material and human resources for the enterprise.

But probably the most important event in 1967 was the reshaping of the program. Until that year educational TV was seen as a means of solving a specific problem: the expansion of the enrollment in the secondary schools. The new Government envisioned the use of TV as a means of inducing a

comprehensive administrative and academic reform of the educational system.

2. OBJECTIVES

After an extensive survey in which the main problems were identified, El Salvador's educators decided that their objectives were to:

- Increase the efficiency of the entire educational system from both an academic and an administrative point of view.
- Improve the quality of teaching at all levels.
- Extend to nine years the basic education of all school-age population.
- Strengthen and extend secondary education—offering a multi-disciplinary curriculum so as to prepare students for vocations as well as university careers.
- Revise and improve the curriculum of grades one to twelve throughout the system.

To what extent have these objectives been realized?

3. PROGRESS TO DATE

Administrative Reform

The implementation of a new administrative system for education is almost completed. A technical study was sponsored by AID in 1968 and carried out by a consulting firm from Puerto Rico. Various services were mechanized, and a new personnel system was designed to undercut the previously existing patronage system. Within the Ministry of Education the Department of Educational TV has enough autonomy and flexibility to perform its functions adequately.

Extension of Basic Education

The most urgent need was to eliminate the bottleneck following the sixth grade, and it was therefore decided to concentrate attention initially on the seventh, eighth and ninth grades of the new educational system; these three grades would have instruction through television.

Starting in 1968 a new curriculum was developed. Teachers and supervisors of the program were retrained in the new curriculum, in new teaching methods and in the use of television in the classroom.

Television programs were produced and appropriate student work books and teacher guides were written. A studio not far from the capital city of the country began transmitting television lessons to 32 seventh-grade classes in 1969.

In the next year, 1970, the new curriculum, teaching materials and television were installed in all seventh grade public classrooms and were introduced in 32 pilot eighth grade classes with 1,280 students. The private schools had to follow the same curriculum but were free to use TV or not. Most of the prominent private schools fully joined the new program.

In 1971, the use of the new curriculum and teaching materials was again expanded to all eighth grade classrooms and to 32 pilot ninth grade classes.

Next year, with a new TV station completed and a new studio in full operation, about 40,000 seventh, eighth and ninth grade pupils are expected to be involved, all taught by retrained teachers using new teaching methods, a modernized curriculum and television.

In grades one through six, another program is being developed. A new curriculum for these grades was elaborated in 1969 and tested in 1970. In 1971 it was extended to the whole system. The training of the primary teachers was carried out simultaneously with the introduction of the new curriculum. The workbooks for the TV classes were printed in a weekly supplement of a newspaper with wide circulation.

In the program of diversification of secondary schools (grades 10, 11 and 12), the new "Bachileratos" in Industry, Agriculture, Commerce, Arts and Pedagogy is already functioning. In 1972 new specializations will start: Tourism, Hotel Management, Fishing and Navigation, Sports and Home Economics.

Teacher Training

The expansion of the seventh, eighth and ninth grades (third cycle) posed a serious problem regarding the need for qualified teachers. The proper qualification for teaching these grades was an undergraduate degree. Yet only 20 percent of the secondary school teachers had this qualification, while at the same time there was a surplus of 4,000 primary school teachers. The Government decided to upgrade the primary school teachers, thus enabling them to teach at the third cycle. All the 69 normal schools were closed, stemming the tide of primary school teachers. Teacher training was then concentrated in one location, "Ciudad Normal."

Each teacher of the third cycle was required to take one year in residence at "Ciudad Normal." Through a rotation system during the last three years, 80 percent of the third cycle teachers have gone through the training program. With the help of new techniques such as micro-teaching they received special training in their field of specialization (either social studies and languages or mathematics and science) as well as instruction in teaching technology (including TV utilization, guidance, and evaluation). By 1972 all the third cycle teachers will have been retrained.

Teacher training for the first six grades is being done through TV itself. Presently the 14,000 primary school teachers work with the students five days a week. On Saturday, they themselves are tele-students, receiving orientation for the use of new programs.

4. EVALUATION

An evaluation of the program was carried out by a research team from Stanford University. Here are their main findings:

"a. *With regard to student's learning and ability*

In both years seventh grade testing showed substantial learning gains in all subjects taught. At the end of the first year test scores from the television classes were about 20 percent higher than those from a sample of traditional classes. In the second year the advantage of television over

'no television' was slightly less, inasmuch as by that time the country had no longer any truly 'traditional' seventh grade class, that is, by the second year all classes were using the new curriculum even if they didn't have TV.

b. *With regard to student attitudes and aspirations*

Surveys from the first two years revealed that students favored the new system as a whole, and television in particular. Nearly three-fourths of the students in the study sample already had more education than their parents, and they were all aspiring to considerably more.

c. *With regard to dropouts and failures*

Students in television classes had lower dropout and failure rates than the sample from traditional classes.

d. *With regard to teacher's attitudes, procedures, and classroom interaction*

Teachers using television in their classrooms for the first time were generally in favor of television instruction at the beginning of the year and even more convinced of its benefits toward the end of the year. In the second year of use, teachers also reported that they were in favor of TV teaching, but they did observe that some of the novelty of the new system had worn off.

e. *With regard to cost*

Instructional television, as everybody knows, is not a shoestring proposition of hiring a few people and spending a few thousand dollars per year. This year the administrative and production staff consists of 160 people, expenditures amount to nearly half a million dollars. People tend to be awed by such a sum, but it has to be looked at in perspective. Compared with a total education budget of $25 million, instructional television amounts to 2 percent of the total."

B. NIGER

Niger is a small, dry, landlocked country in northwest Africa.

The Niger educational television pilot project was planned in 1963 and began its operation in 1964.

It is a small project, the first one in Africa designed to give youngsters complete instruction by TV, and the first to use classroom monitors— usually young men with no more than a sixth-grade education— to offset the teacher shortage.

In October 1964, classroom monitors were trained and pupils were selected for two experimental one-room television schools located near the studio. In November of that year the first of 400 television programs began. At the end of the school year the production staff reviewed the program and decided what to reuse, change or discard.

The next year 20 more schools were added and 800 students viewed the television programs.

The monitors received a quick three months training program. They were given guidebooks to go along with the television courses. The monitors prepared the pupils for the TV lessons, then followed them up and assigned appropriate activities geared to the abilities of the individual pupils in the class.

The TV teacher seldom just delivered a lecture. The emphasis was on games, dramatic sequences, open questions, and problem solving.

In a typical TV classroom in Niger the students sit on clay floors in concentric circles around a TV set. During televised math lessons the children often do their own problems on the clay floor. After the TV lesson the children participate in an activity related to the lesson they have just viewed.

Although the TV project in Niger is small, its achievement has been impressive. One measure of its success is the very low failure rate within the TV classes themselves—out of 800 pupils, none failed, while the average rate of repeaters in the traditional classes was about 25 percent. Equally impressive, although unmeasurable, is the effect that television seems to have on the children—called by some a type of "personality explosion."

As for student achievement: 96 percent of the pupils in TV classrooms passed a French language comprehension test after the third year, and 60 percent passed a French spelling test. Pupils in traditional classes performed at a significantly lower level.

The Government of Niger has asked that the experiment be extended to the fifth primary year, but so far it has not expanded beyond the 22 schools.

No one knows what will happen after October 1972, the date the present experiment is now scheduled to be completed. The reports are that survival, as well as expansion, will depend on outside funding.

C. AMERICAN SAMOA

American Samoa was one of the first areas in the world to undertake a comprehensive educational reform based on television.

American Samoa consists of seven islands in the Pacific south of the Equator, with an estimated population in 1967 of 26,000. School attendance is compulsory until pupils complete grade 12 or reach 18 years of age.

In 1968, public schools enrolled approximately 8,000 students, and church schools about 1,600.

In 1961 the Governor of Samoa, an appointee of the U.S. Government, undertook to upgrade the educational system of the islands to a level comparable to that of the mainland. His decision was based partly on the fact that some 40 percent of Samoan high school graduates leave the islands to take jobs in Hawaii or in the continental United States, and they needed a better education than they were getting in order to compete with mainland graduates.

According to reports, the Samoan educational system prior to 1961 had no school plant to speak of, no organization, no body of trained teachers,

nor administrators, no educational goals, and only a limited and not very well defined curriculum. The 43 village elementary schools were run down. The textbooks used in the schools were produced on the mainland for mainland children, and were somewhat inappropriate for the Samoan child. By comparable American standards Samoan teachers averaged no more than a fifth grade education.

After considering other alternative solutions to the problem such as import of American teachers, and training of Samoan teachers on the mainland, the Governor arranged for a small group of U.S. educators and television specialists to come to the islands to help restructure the educational system using television as a core for the program instead of just a supplement.

Television would teach the students and, at the same time, provide the Samoan classroom teacher with additional in-service training. The Samoan classroom teacher and the American television teacher would, in effect, team teach.

In October 1964, the first three TV channels began broadcasting to a few elementary classrooms. A year later three additional channels began broadcasting to secondary schools. Each lesson, both elementary and secondary, lasts 45 minutes and has three distinct parts: (1) preparation for the telecast using the daily lesson plan distributed one or two weeks in advance; (2) the telecast itself; (3) reinforcement activities.

English language proficiency is stressed through the basic curriculum in language arts, mathematics, science, and social studies. A modest amount of time is devoted to vocational programs.

The educational system in American Samoa has undergone a major overhaul and redesign during the last decade. The system as it operates today is much more than just television. It includes specially designed schools, teacher supervision, in-service teacher training, and curriculum without rote memorization.

The reports from Samoa are that in the past seven years students have profited considerably from the use of television. For example, tests show remarkable gains in speaking and understanding English. At the secondary level, however, results were less promising. The majority of current Samoan high school graudates are not yet prepared to compete in an English-speaking society. They were not able to adjust quickly enough to both a new curriculum and an entirely new method of teaching.

D. IVORY COAST

One other country that is beginning a comprehensive educational improvement program using television is the Ivory Coast.

In March 1970, representatives of the Ivory Coast, France and three United Nations agencies formally agreed to collaborate on a ten year $500 million nationwide classroom television system. The project will equip primary schools for a million Ivory Coast children with TV sets (to be provided by France) and build curricula around their use.

This appears to be the world's most ambitious educational TV project

to date. The plan calls for a television receiver in every grade-school classroom in the country by the year 1980, with most teaching done through television.

In full operation, the new educational program is expected to:

- more than double the number of children in primary and secondary schools in the country;

- demonstrate that instructional television can reduce the percentage of school dropouts and grade repeaters when used on a national scale in an underdeveloped country.

For more than four years UNESCO worked with the Ivory Coast in planning the project. France will provide the necessary technical experts; the World Bank is providing $4 million for construction of a number of buildings including a training college for classroom teachers who will supplement the instructional television programs. The Bank is also financing a center to produce a French-language instructional program.

The first experimental telecasts began in October 1970; by October 1971 televised classes will be offered to first graders in 600 schools.

Many of the TV sets will be battery operated, usable in communities with lack of electricity.

Ultimately, instruction is to be provided for all pupils in the first four grades.

UNESCO and French technical experts believe that (a) young children are very receptive to televised teaching, and (b) that in developing countries the teaching of young children is generally inefficient and inordinately expensive.

E. GREAT BRITAIN[2]

1. *Adult education* through TV, radio and correspondence is common in many countries. Usually it is considered as a low-ranking appendage to traditional institutions of higher education. However, Great Britain has pioneered the integration of all these techniques into one program, which offers all adults a chance for a university education, whether or not they possess the traditional academic qualifications.

In the beginning, it was conceived as the "University of the Air." This conception, however, conveyed an exaggerated idea of broadcasting, calling for a large allocation of air time. This situation brought up two kinds of problems: (a) costs of air time in Great Britain are very high: $1,500 per hour of BBC radio; (b) broadcasting alone can help to direct teaching in only some subject areas and then only for reasonably mature students. The great majority of adults, however, need more assistance and orientation.

The solution to both problems called for a combination of several media: (a) Broadcasting was reserved for those functions which it was best equipped to perform; (b) individual instruction through correspon-

[2]Based on the oral presentation made by Dr. Keohane.

dence was made available everywhere and cheaply. At the same time, discussion groups and short periods of residence were established to support instruction.

2. *The Open University* began its operations in January 1971, offering four courses leading to degrees in social sciences, the humanities, mathematics and science. Initial enrollment was about 30,000 chosen from 43,000 applications on a first-come, first-served basis. The first-year students are predominantly middle class. About 33 percent of the students are teachers.

The central campus of the Open University is located on a 70-acre site 50 miles north of London, where a full-time faculty and administrative staff construct courses, produce and distribute print and non-print correspondence materials, and maintain student records. Future plans include 250 regional study centers where students can watch TV programs and meet with tutors—a corps of 2,500 professionals holding academic posts at nearby educational institutions.

It is hoped that this kind of tutelage will help combat the high dropout rate usually associated with most correspondence teaching.

The British Broadcasting Corporation broadcasts weekly four hours of radio and television lectures for each course. The contract makes provisions for 30 hours of radio and 30 hours of TV weekly. The programs attempt to bring the student at home closer to reality than would be possible through the use of printed descriptions. For instance, the TV science courses are designed to bring the laboratory to the student. He is able to witness close-up views of sophisticated equipment that a normal student would probably never see.

Basic financing is provided by the British government which allocated $10 million to establish the operation. It is estimated that the yearly operation budget will approach $19 million. Students will be required to pay $100 per course which is considerably below the cost in the traditional British universities.

The Open University faces several problems. The first is the traditional stigma of dubious quality often associated with correspondence study and after-hours instruction. Another key problem is the difficulty of creating a good working partnership between the academic departments of the Open University and BBC, which produces the technological components for study. At the base of this problem of equal partnership are the real doubts in the minds of all engaged in the Open University as to the role of radio and television in higher education. On one level there is a straightforward answer—without the technology of broadcasting the Open University could not do the job it is setting out to do. Provision of high quality education to large numbers of students distributed unevenly all across the nation requires some use of a mass distribution system like television. But on a deeper conceptual level, the function of broadcasting in university courses becomes more difficult to identify if one accepts that the technology should be used to do more than just transmit University lectures.

One of the haunting dilemmas at work here is that very little is known about the comparative fitness of media for instruction.

F. SPAIN[3]

The process of Educational Reform that is taking place now in Spain began in October 1968. Various working meetings with teachers and specialists took place until February 1969. The resultant studies were published in the so-called "White Book" which laid out the basis for a new educational policy.

The "White Book" was submitted to a period of public discussion of its goals and lines of educational policy.

The results were translated into the Bill of Education and Financing of the Educational Reform which was presented to the *Cortes*. Thirteen thousand amendments were presented to the legislation which was finally approved in July 1970.

1. THE PRESENT EDUCATIONAL SYSTEM

Actually the structure of the present system in Spain is not very different from that established in the 19th century. Some new methods have been added to this traditional structure, but without any true integration.

Essentially there are two educational systems in Spain: one for the rich, another for the poor. Children who are predetermined by class condition to go to secondary school attend primary school until they are ten years old; the others go to primary school until the age of fourteen. For the latter the only possibility of continuing their education lies in the professional schools which offer very few connections with other educational levels.

The ones that are privileged enough to follow the secondary and higher education levels have to contend with the rigidity of the traditional structure. The change from one system to another is difficult for lack of a flexible system of interrelations.

The educational pyramid continues to reflect the elitism of the system. Of each group of 100 students who began primary education in 1951; twenty seven entered secondary school, ten passed secondary school, five passed pre-university and three finished university studies in 1967.

2. OBJECTIVES OF THE REFORM

The Educational Reform has the following objectives embodied in the new Law: a sound general education which will take into account the *structure of employment;* one common system and special sub-systems for specific classes; easy progress from one level to the next and easy reentry for those who have had to interrupt their studies; free but voluntary preschool education and free and compulsory primary school education; pedagogical renovation, reform and continuous experimentation; autonomy of educational centers to develop in their own social milieu.

Moreover, the intention is to transform the nature of the system from one that emphasizes the memorization of fact to one that is oriented

[3]Based on the oral presentation by Dr. Prabhakar.

towards social and professional reality and geared to the student's development of creativity and responsibility.

In order to achieve these objectives a plan was developed by the Government with the assistance of UNESCO which will rely heavily on the use of modern technology both for teacher training and for student use.

3. TEACHER TRAINING

The Spanish Government recognizes that teacher training is the key to the renovation envisaged by the Law of Education. Existing and future teachers need to be trained in the new spirit and in the new content and methods.

According to the Law the pre-primary and primary school teachers (General Basic Education Schools) should be trained in the *Escuelas Universitarias* (EU). They are to replace the present teacher training schools and there will be 57 of them. They will be under the supervision of the 15 *Institutos de Ciencias de La Educacion* (ICE). The 15 ICEs are situated in the regional universities, staffed (besides a full-time staff) by particularly dynamic professors who participate in the functions of the ICEs as an adjunct to their normal teaching and research responsibilities in the Universities. The ICEs will be directly integrated into each University and will be charged with the teaching of pedagogy to those University students who are planning to enter the teaching profession. They will also be responsible for in-service teacher training and will carry out and promote educational research and serve as technical advisors to the University to which they belong. The activities of the ICEs in educational research will be coordinated through the CENIDE (National Research Centre for the Development of Education) in Madrid.

After their specialized university education the teachers for secondary schools and Universities will receive professional and pedagogical training in two stages. The first stage will come during the fifth year of their University course and will consist of four seminars of one week each in the ICEs. Their topics will be educational problems, microteaching, participation in training groups and CAI (Computer Assisted Instruction).

Regular attendance and recommendations by the Directors of the seminars can be used to regulate entry into the second stage. This stage consists of one year of training.

About 60 percent of the time of the students will be taken up with teaching a small class (of about 12 children) in an experimental school associated with the ICEs. Teaching will be complemented by intensive group discussions, at least five hours per week, of the classroom experiences of the young intern teachers. The remaining time will be devoted to the study of one of the following technical subjects: TV, Programmed Instruction, and CAI.

4. THE PLAN FOR COMPUTER ASSISTED INSTRUCTION (CAI)

The Spanish Reform has recognized and explicitly stated that the goals of education should be far more than the accumulation of knowledge.

In fact, as technology progresses mere factual knowledge becomes less and less important to the individual. We have more and better encyclopedias and data banks to carry this burden. We are free to bring back again the classical goals of education: to develop broad notions, clear thinking, intuition, aesthetics, imagination, in a word to create responsible citizens who are self-confident, energetic, incisive and discriminating.

The CENIDE laboratory (the central one is in Madrid) has such diversified functions (teacher education, experiments with children, development and listing of equipment for the 15 ICE's and 57 EU's, software research and development, computer-aided documentation, information retrieval, simulations, and routine data processing) that a conventional but versatile medium-size computer facility has been specified. The medium-size computer will support the teaching "modules." One of these modules will be installed at CENIDE, one in each of the 15 ICE's and 57 EU's, making a total of 73 modules. A module consists of a mini-computer with sixteen terminals. This equipment must be operational in CENIDE in this fall (1971) in order to meet the scheduled plans of the ICE's and EU's. In the interim, thirteen uniscope terminals have been installed at CENIDE and connected to the Ministry's UNIVAC 1108 computer. This will permit some software development and some training of the CENIDE staff. The UNIVAC 1108 will continue to be used as long as there is space capacity as a large back-up computation facility supporting the medium-sized CENIDE computer.

Investment costs are here distinguished from recurrent costs, because the investment costs will involve expenditures outside Spain. These expenditures will go largely for hardware and training abroad and will amount to a total of 10.2 million dollars for the six-year period. The recurring costs, which will be local, will consist of salaries for CAI staff, materials and services and will amount to 2.9 million dollars when the project is in full operation.

To represent these costs differently, we might calculate that the 73 mini-computers with 16 terminals each will have a total of 1,168 terminals. These will be in use at an optimum of 10 hours per day for 220 effective days per year and will cost about $1.90 dollar per terminal hour. It is expected that the general level of teacher education produced by this introduction of CAI will more than compensate for the financial investment required.

Finally, an evaluation model is built into the project to start simultaneously with the project itself. The cost of the independent evaluation team will be $800,000.

G. BRAZIL COMMUNICATIONS SATELLITE PROJECT (SACI)[4]

The enormous expanse of Brazil, the dispersion of its population, and all the usual educational problems of developing countries such as high rate of illiteracy, dropouts and repeaters, a high percentage of school-age

[4]Based on the oral presentation by Dr. Mendonça.

children out of school—all these problems taken together call out for bold new solutions.

The National Institute of Space Research (INPE) is proposing educational TV transmitted through satellites as one solution.

The so-called "SACI Project" is, at the present moment, a feasibility study for the utilization of two satellites to transmit programs for the up-grading of teacher and student education.

If the project is approved by the Government the transmission to 150,000 schools will start in 1976.

A pilot project, using a small satellite, is already in an advanced stage of design and is scheduled for operation in 1974. The pilot project will take place in the State of Rio Grande do Norte and will provide training for 700 teachers in 500 schools with 15,000 students.

The cost estimates for the SACI project show that the transmission hardware is a relatively small part of the total budget.

The implementation of the project is estimated to cost around US$350,-000,000 over a period of five years. This includes the cost of 150,000 receivers, the software for the first year, and the in-orbit cost of the two satellites which represent less than ten percent of the above amount.

The recurrent cost per year for the operation of the system is estimated at US$100,000,000.

The preparation of an hour of TV program requires 200 man-hours. Thus, a year of primary school broadcasting requires 1,000,000 man-hours. If the system were also to broadcast for secondary schools, the recurrent cost would skyrocket since 11,000,000 man-hours would be required for one year of broadcasting.

A smilar project of TV by satellite has been studied by Argentina. Its preliminary findings and plans are contained in a brief statement prepared by Dr. Conrado Estol (see Appendix II).

H. BRAZIL-ANCHIETA FOUNDATION

This serves as an example of how educational technology can be used to add another dimension to instruction without any change in the formal educational system itself.

It is a long tradition in Brazil (as it is in other countries) to give people who have not had a formal education the chance to receive an equivalent certificate through qualifying examinations. The certificates can be obtained by examination for two levels of secondary education: the *ginasio* (junior high school) and the *colegio* (senior high school). These are called examinations of *madureza*.

The possibility of achieving the high school *diplomas* through *madureza* examinations attracts a great many people seeking to pursue their studies at the university level or simply needing the status of certification that is still important in Brazil.

The majority of the candidates realized, through the high rate of failure recorded in the *madureza* exams, that they could not prepare for these exams by themselves. This realization in turn has generated a large industry

of small private schools (*cursinhos*) that claim to prepare students for the exams in one year. Without supervision, lacking human and material resources they do not in fact provide an adequate preparation for the *madureza* examinations.

In view of this situation, the official educational TV station of the State of São Paulo, controlled by the Anchieta Foundation, designed a course to prepare students for the ritual of the exams and at the same time to impart knowledge more relevant for their lives. The course started in 1969 and was directed to candidates for the *ginasio* exams which took place in 1970.

The students, 40,000 in all, received a weekly workbook to complement the daily broadcast lessons. The TV classes could be attended at home or in one of the 76 "teleposts" spread throughout the State. Each "telepost" has a monitor.

A study of a sample of the 85,043 candidates for the exams led to the following conclusions:

1. The majority of the candidates (53.55 percent) still use the *cursinhos* as a means of preparing for the exams.
2. Eleven percent of the candidates took their TV classes at home, and 12.6 percent at the "teleposts."
3. Among the candidates who passed, the proportion was higher for those who had used TV at home.
4. The precentage of candidates approved in the exams who used the "teleposts" as the only means of preparation was lower than for those who used TV at home or attended *cursinhos*. It is possible that the candidates who used TV at home were better endowed socially and economically than those who had to go to a "telepost" to attend classes.

The study measured only the degree of success in the exams. But since the TV courses have objectives that go beyond simply passing the *madureza* exams, the next evaluation might measure the complex of behavioral and attitudinal changes which the program purports to induce.

III

THE ISSUES ON IMPLEMENTATION OF EDUCATIONAL TECHNOLOGY

A discussion on strategies of implementation followed the presentation of each case study. Issues like costs, planning, fitness of educational technology were frequently referred to in various contexts. We here summarize the main tendencies and positions of the participants of the Workshop on these issues.

The exchanges of experiences, the opinions and positions expressed, were fairly representative of the present stage of knowledge about educational technology and also of the main doubts, worries, scepticisms and enthusiasms of educators, administrators and experts.

A. FUNCTIONS OF TECHNOLOGY IN EDUCATION

Different positions were expressed regarding the functions of educational technology in the learning process.

Some participants endorsed the idea that technology was an aid only in the cognitive aspects of education. Television, radio, computers, etc. are devices that can be used only to alleviate the teacher's task of transmitting information, and to allow him more time for the transmission of values and attitudes. The cognitive domain can be the realm of the machine, but the effective domain should be solely the teacher's function.

On the other side, it was argued that in developing countries the function of the teacher is usually already established as the transmitter of knowledge. Hence one of the main uses of technology would be exactly to change the teacher's concepts and attitudes towards teaching. Educational technology should have a catalytic role in opening the minds of teachers to values other than those traditional in the local community.

This position seemed to be dangerous to some participants, who feared the excessive influence of technology in the cultural-values system. Philosophical considerations of educational policy have to be taken into account in the organization of the curriculum as well as in the selection of technology. These considerations involve cognitive as well as effective aspects. The uses of educational technology should be subordinate to educational goals. The question should not be to decide which technologies would be best *per se*, but which technologies best fit educational goals and purposes.

One participant called attention to the danger of accepting the old-fashioned idea that the school is the only source of education. Students are constantly exposed to facts and values received through many channels. The teacher's function should be to discuss these facts and values transmitted by sources outside the school. And still better than one teacher would be a team of teachers whose balanced influence would avoid monolithic indoctrination.

Examples were given which pointed out that the real value of educational technology lay in the change of attitude which it induced in the teacher. He is forced to organize his subject matter better, and to know how his students learn, what they learn, and what they do not learn.

In these discussions another related point was stressed. New media like TV, radio and computers are highly complex and require centralized operations. Programs broadcast by radio and TV are necessarily standardized. Consequently, when made integral parts of a system, they may impose rigid uniform patterns of instruction and impede the teacher's initiative in the classroom. In a wider sense, the uniform programs might ignore the local "color" of specific or rural situations.

To some members of the Workshop the ideal of individualized instruction according to individual capabilities and local "color" seemed to be a remote achievement for the distant future. For developing countries the most urgent priority should be the establishment of a sound basic education for everyone; hence, the main utility of educational technology would be its contribution to this objective.

B. PLANNING

For many reasons the Bahia Workshop emphasized the need of planning before the introduction of advanced technology in education: its high cost, its "disruptive" effect on the traditional system of teaching, its multipurpose capabilities. The participants cited the examples of El Salvador, Spain and Great Britain to support the view that media like TV, computers and radio are complicated instruments, and that they cannot simply be grafted on to the traditional system of education. In these cases a system-wide reform preceded or was concomitant with the adoption of such media. In El Salvador, as already pointed out, TV was an integral part and a strong support for carrying out the reform of the educational system of the country.

Planning the introduction of educational technology was considered particularly important because many aspects of the infrastructure are essential in the use of advanced technology. The participants recognized a generalized tendency to concentrate attention on the "hardware" and the installation of computers and TV networks. Less attention is generally given to the "software" and how best to use the equipment. In particular, the need of preparing the teachers and of reorganizing the methods of teaching seemed to require a planning and programming effort which was rarely found.

In the introduction of advanced technologies two strategies were stressed: one, involving grass-roots participation by the teachers and intensive discussion in the political areas, before the final decision, as in Spain; the other, coming from a decision of the central government made from the top down without massive participation by the teachers in the decision-making. This was the case in El Salvador.

Developing countries have a long history of shelved plans whose implementation just barely started when a new government refused to continue a project started by a previous regime. Thus, the question of continuity was seriously considered because of the high cost involved in the operation of sophisticated media. No clear answer was found to this problem. The only guarantee of continuity lies in the quality of the technical personnel, in the good results of the programs and in the support that legislation and political forces can provide.

C. SELECTION OF ADEQUATE TECHNOLOGY

One of the most crucial issues discussed at the Workshop had to do with the selection of adequate technologies and this divided the participants into antagonistic camps: some experts and administrators were in favor of a progressive adoption from less sophisticated to more advanced technologies. They argued that advanced technology like TV should not be introduced if the country has not had any previous experience with radio. The lack of experience and infrastructure of one medium like radio might handicap the success of a more sophisticated medium like TV. Their advice was to proceed stage by stage and not to jump immediately to more advanced technologies.

Other members of the Workshop favored an opposite strategy: they advocated an immediate jump ahead to more advanced media. They argued that with this strategy it would be easier to mobilize resources, both human and financial. Media with greater novelty and sophistication might have stronger appeal to help carry out radical reforms. The examples of El Salvador, Niger, Ivory Coast and others were brought up in support of this idea. In most of these cases, except in El Salvador, TV was introduced first for educational purposes, even before the commercial channels were in operation. It was emphasized that the appropriate media should be chosen for their long-range capabilities rather than for their short-term costs.

The problem of importing technologies was extensively discussed. Some argued that the technology of developed countries were capital-intensive, while developing countries have abundant human resources and a lack of capital resources. It would be better for these countries to use more labor than capital in solving their educational problems.

Even the successful experience of El Salvador in the use of TV was not considered necessarily "exportable" to other developing countries. Too many of the peculiar conditions in El Salvador are not met elsewhere.

Special mention was made of the responsibility of international organizations and advisors in the selection of technologies. Their advice should take into consideration the local resources, capabilities and infrastructure of the communication system to avoid catastrophic misfits. Computers, satellites and TV, for instance, require a well established network of communication to operate well and small deficiences can paralyze the whole system.

D. TEACHER RESISTANCE

One point accepted by every participant was that the greatest resistance to educational technology comes from the teachers. They frequently consider it an infringement of their freedom of *catedra*. At other times they feel threatened by criticism and by their unfamiliarity with the new media. To overcome this problem mention was made of sensitivity training, T-groups, and intensive training courses in the use of media for teaching.

It was pointed out that resistance to technology also came from political groups and from teachers' unions, as in the case of El Salvador and Spain.

E. COSTS

Costs of adopting advanced educational technology were also discussed. Some participants complained that planners eager "to sell" a new program do not take into account all the costs that are really involved. The initial capital investment usually represents a small fraction of the total costs. The recurrent costs with software preparation, equipment replacement, and maintenance are usually underestimated when they are estimated at all. Furthermore, comprehensive and independent studies of cost-benefit are seldom undertaken.

The opposite point of view was that the technology which allows more students to be reached helps to reduce the unit costs and especially the costs per graduate when reduction of dropouts and repeaters is achieved. Moreover, there is always the question of the immeasurables of quality improvement that resist a price attribution.

Examples were brought up which showed that at the university level TV and closed-circuit helped to reduce the student-teacher cost ratio. The "Open University" was a clear-cut example. In Guatemala, to overcome the lack of prepared teachers in Economics, four universities decided to have one good course in common broadcast by TV instead of several poor courses. Reference was made to the study on the technology of instruction carried out in Mexican Universities by Noel F. McGinn, Russell Davis and Richard King,[5] which suggested that use of technology was significantly higher in large classes, thus reducing the unit costs. As might be expected, there was a close relationship between the size of the school's budget and the availability of technological resources.

Maintenance costs were also stressed. These costs are very seldom included in the cost estimates, although they are, of course, very important. In a recent survey carried out in Great Britain, it was shown that at any moment 25 percent of the privately owned TV sets were out of order; in the high schools this increased to 58 percent. Such problems could be even more serious in developing countries. Systems analysis was proposed as a way to cope with this problem. The systemic approach properly used could establish a flow of information on "hardware," "software", and "processing", and the pitfalls and drawbacks could be more readily identified.

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[5]Noel F. McGinn, Russell G. Davis, Richard King. *The Technology of Instruction in Mexican Universities*. New York: Education & World Affairs, 1968.

IV

PROSPECTS FOR THE FUTURE

The Workshop reflected the present stage of knowledge of educational technology. A sample of administrators, educators and experts from developed and developing countries, coming from international organizations or domestic institutions of education tried to put together their experiences, findings and projects. Their common vision of the subject may be summarized as follows:

1. During the last decade advanced technologies to improve education have spread rapidly throughout the world, in developed as well as in developing countries. This movement seems likely to increase for the next two decades. Television and radio appear to be the media most frequently adopted. Satellites reinforce the use of these two media. Computers, on the other hand, are still 15 years behind TV and radio, and their main contribution is still in the area of research and administrative tasks. Much more project experimentation and reductions in cost are required before the computer's capacity can be fully exploited for educational uses.

2. In most of the projects, educational technology seemed to be adopted as an "add-on" to existing educational programs. But a few impressive examples are to be found in countries introducing educational technology as an instrument to remake and reform the entire educational system. Technology becomes an integral part of the reform. To use advanced technology effectively important changes in the structure of education must be introduced. This was one of the major conclusions of the Bahia Workshop.

3. Experiences with educational technology have, as a by-product, opened up new insights into learning theory. Technologies may help educators to understand how people learn, and, reciprocally, knowing how people learn may lead to more appropriate technologies. This aspect should be made a conscious and explicit objective of future experimentation. Moreover, dramatic improvement in the process of planning organizational change can be expected in the future from the introduction of technology as an integral part of educational systems.

4. The final recommendation, strongly endorsed by each of the Workshop participants, centered on the need to ensure the availability of and ready access to research findings, evaluations and other data relating to new developments in educational technology. All were agreed that the information gap constitutes a serious handicap to continued progress in this field. Many costly false starts and outright failures could have been avoided if project planners and directors had had before them the record of experiences gained by others who had plowed similar fields.

In an area as new and as fast-moving as this unquestionably is, the findings and insights gained through the analysis of pioneer experiments are all relevant to some degree, however much actual conditions may differ. Nor is learning from the mistakes of others the only benefit to be

derived. More positively, the development of a sound theoretical base for the application of communications technology to education can proceed only if a complete case by case record of experiment using the new technology is available for interested parties to draw upon. Parts of this record do of course exist, but their existence is not widely known nor is there easy access even to the printed materials.

It was the unanimous recommendation of the Workshop that a Latin American Regional Center of Educational Technology be established without delay to close the information gap. The Center would serve initially as a clearing house, with responsibility for the collection and dissemination of information on experiments in educational technology, and for the development of methods to evaluate the results of such experiments. At a later time, the Center would be expected to acquire a research capacity of its own, with a staff equipped to explore the theoretical implications of the experimental data.

Funding for the Center should ideally come from multiple sources—international and regional agencies and banks, governments, private foundations and other granting institutions. It is to be hoped that the response of these organizations will be positive and constructively critical —with eyes open to the possibilities which communications technology may offer to the solution of the developing world's critically important educational problems.

APPENDIX I

RECENT DEVELOPMENTS IN INSTRUCTIONAL TECHNOLOGY IN THE DEVELOPING WORLD*

By Sidney G. Tickton

Academy for Educational Development, Washington, D.C.

Today many countries around the world use some form of technological media in education. In a few countries the use is fairly widespread. However, most technological devices and programs are structured around the needs of the teacher and are employed as teaching aids in the classroom. In other words, most educators are using technology to answer the question:

How can technology help the teacher?

A few areas, however, focus education on the needs of the student. Educators ask a different question:

How can technology help the learner?

In the few instances where the student is the center of attention, technology is a catalyst for educational change. Removing technology would make a significant difference to the educational process, because technology is an integral part of a well-thought-out-system. It is no longer primarily a teacher's aid.

Technology as an aid to the teacher undeniably has its place, but it is technology organized to improve student learning and educational reform that has most interested me and my associates at the Academy for Educational Development during the past few years. For this reason, in part, the U.S. Agency for International Development asked us to prepare a handbook which outlines, on the basis of experience to date, the most promising ways in which technology is used to improve education in a few countries. When completed the handbook will be printed in three languages and presented along with a film at seminars of top education officials in the developing world. The film commentary will be in several languages, too.

The film focuses on two examples of educational technology—the catalytic use of television in El Salvador and Niger schools. The examples are diverse in setting and scope, but have in common the use of technology as an ingredient for educational change.

In preparing the handbook and film we sought answers to three main questions:

(1) What do the newer technologies offer education?
(2) Can they help solve the educational problems facing countries around the world?

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*A paper presented at the Educational Technology Workshop sponsored by the Council on Higher Education in the American Republics—May 26-29, 1971, Salvador (Bahia) Brazil.

(3) Can the new technologies help improve curriculum, make education more responsive to individual students, reach more people, and fill gaps left by a shortage of trained teachers?

There are no simple nor indisputable answers to these questions at present. However, our investigations revealed some distinct trends and significant clues. They lead us to believe that while technology is no instant cure for the crises facing education, technology properly used can increase the effectiveness and productivity of the educational process, multiply the impact of the really effective teacher, and thus improve learning.

As everyone knows, the list of countries employing technology for numerous educational purposes includes all continents, both large and small countries, and rich and poor locations. However, only a few countries in the list build technology into their educational systems to improve the educational process substantially in a short time. These countries are achieving results which American schools cannot equal. They are, in effect, charting some promising educational futures.

The handbook presents three case studies—in El Salvador, Niger, and American Samoa—and the plans for one new project in the Ivory Coast. Each example utilizes television as an integral part of educational reform. A number of other places, too, have developed the use of educational technology and the handbook briefly describes a few about which sufficient information could be obtained.

The handbook reports mainly on countries using technology in the comprehensive restructuring of educational systems to provide results not otherwise thought possible. In the three countries cited as case studies, TV is primarily a catalyst for reforms that would not otherwise be likely to occur. Included are curriculum revision, new teaching methods, new subject content for educational programs, retraining of teachers, production of new teaching materials, workbooks and teacher guides, as well as the television programs. In addition, there is an organized attempt at feedback and evaluation.

"Feedback" is a comparatively new word in education borrowed from electronics. It is used to describe the process of informing the teacher of the effectiveness of his message so that the message, or the process of delivering it, can, if necessary, be modified. Feedback and the measurement of results attempt to answer the questions: Are the students really learning? How do results achieved by one learning system compare with results achieved by an alternative system? Feedback and measurement are essential for continually improving an educational system, particularly one using educational technology.

Most countries using television or radio for education expend enormous initial effort mastering the technique and technology of the new medium but usually allow little time for systematic evaluation. And the high costs of equipment, program production, and training have left little money available for feedback and evaluation systems. However, in the three examples cited in the handbook, feedback systems were built in from the beginning and have been, we believe, enormously useful.

EL SALVADOR

El Salvador began a program of school reform in 1968 after intensive examination and evaluation of the country's educational problems. The purpose of the reform was to make new and better things happen in the classroom—for the benefit of the student and the society, too. The program was built around educational television, with funds and technical assistance provided by the U.S. Agency for International Development.

After evaluating goals and priorities, the planners began the reform program with the junior high schools (Plan Basico)—the seventh, eighth, and ninth grades, which enrolled a total of about 40,000 pupils. Starting in the fall of 1968, curriculum was revised for a limited number of seventh-grade classes; teachers and supervisors for these classes were retrained in the new curriculum, in new teaching methods, and in the use of television in the classroom. Television programs were produced and appropriate student workbooks and teacher guides were written.

A studio not far from the capital city of the country began transmitting television lessons to 32 seventh-grade classes in February 1969, the beginning of the Salvadorean school year. The plan was that during the first year (1) the amount of student learning would be assessed and analyzed; and (2) the production specialists would obtain the experience and confidence necessary to make possible a smooth operation and good results in the second year when TV instruction was to proceed forward on a much larger scale.

Extensive teacher retraining and planning for program expansion proceeded during the school year 1969. The next year, 1970, the new curriculum and teaching materials were extended to the entire seventh grade. Television was introduced in all seventh-grade classrooms which had receivers, and in 32 pilot eighth-grade classes.

This year (1971) use of the new curriculum and teaching materials again expanded to include the entire eighth-grade, and television was introduced in 32 pilot ninth-grade classes. Some 24,000 pupils in 150 schools are participating in the program.

In 1972 with a new television station and a new studio in full operation, about 40,000 seventh-, eighth-, and ninth-grade students—virtually the whole of Plan Basico—will be participating in Salvador's educational reform, all taught a modernized curriculum by retrained teachers using new teaching methods and television, where receiving equipment is available.

One important and very interesting aim of the Salvadorean educational reform program was to retrain all 900 junior high school (Plan Basico) teachers. This was a substantial undertaking for a small country. Moreover, it was a step often omitted from other educational reform or TV instruction programs throughout the world. In Salvador the planners thought that this step was most critical and had to be done well. The Minister of Education agreed and provided personal assistance. As a result, every teacher in the junior high school by the end of this year (the third year of operation) will have undertaken a teacher retraining program in residence at a new

normal school set up especially for this purpose.

At the very beginning, teachers took a retraining course that ran for only three months. The graduates taught the first 32 pilot classes and were later to become the first group of supervisors. At the end of the year, this first group came back for additional training. However, starting with the second group the retraining program ran for the entire nine-month school year. Some 260 teachers in the second group received special training in either social studies and humanities or math and science, as well as instruction in teaching with television, and some background in guidance and evaluation. During the retraining period the teachers received full salary, room, and board at the normal school.

Obviously, during the past three years a considerable amount of rotating of teachers and improvising of activities was necessary, but the results worked out well. Some primary school teachers—Salvador had many unemployed at the time the educational reform program started—were appointed as substitutes for junior high school teachers being retrained.

One of the special aspects of the teacher retraining program was the use of microteaching, a new audiovisual arrangement pioneered a few years ago at Stanford University. The teacher's activities in front of a classroom or a small group of students were videotaped; they were then played back to the teacher, the supervisor, and sometimes other members of the teacher-training class for examination, criticism, evaluation, and learning. The idea was to provide the teacher being trained with some feedback on the adequacy of his or her performance before the class. What did he do right? What did he do wrong? What and how could he do what he had done better the next time?

After the first two years of the El Salvador reform the evaluators concluded:

1. *With regard to students' learning and ability:*

   In both years seventh-grade testing showed substantial learning gains in all subjects taught. At the end of the first year test scores from the reformed classes were about 20 percent higher than those from a sample of traditional classes.

   Everyone in the TV classes, whether rich or poor, from the city or the country, male or female, with high or low ability, came out better in the end-of-the-year achievement tests. Early fears that only the most advantaged students would benefit from TV did not materialize. In fact, TV and the reform program may be narrowing the gap between the better and the poorer students.

2. *With regard to student attitudes and aspirations:*

   Surveys from the first two years revealed that students favored the new system as a whole, and television in particular.

   Nearly three-fourths of the students in the survey sample already had more education than their parents, and they were all aspiring to considerably higher levels. The sample of ninth-grade students showed high aspirations to continue on to the university. Fifty-five

percent of the seventh- and eighth-grade students said they would seek semi-skilled jobs. Almost 40 percent wanted professional occupations.

By contrast, 70 percent of their fathers worked in unskilled jobs, only 10 percent in skilled jobs, and no more than one percent in the professions. Lofty aspirations may cause some difficulties in the future. The universities will have enrollment limitations and it will not be possible for all students to reach either educational or occupational goals.

3. *With regard to dropouts and failures:*
   Students in television classes had lower dropout and failure rates than the sample from traditional classes.

4. *With regard to teachers' attitudes, procedures, and classroom interaction:*
   Teachers using television in their classrooms for the first time were generally in favor of television instruction at the beginning of the year and even more convinced of its benefits toward the end of the year. In the second year of use, teachers also reported that they were in favor of TV teaching, but they did admit that some of the novelty of the new system had worn off.

   Observers consistenly reported that during the first year of educational reform the classes under the new system seemed to be livelier, more appealing visually, and more challenging intellectually than the "old style" classes. As opposed to traditional classes the new system resulted in less lecturing, more questions requiring thought rather than memory, more discussion, more individual study, and greater use of visual aids. The first year results showed no giant leaps forward but rather a steady, consistent mover toward modern styles of teaching.

5. *With regard to feedback:*
   The researchers in the program devised systematic television tests to provide the information that the television teachers and the production teams needed most: that is, how much the pupils were learning. Last year the feedback system brought results back to the studios for two subjects within three days after the program was shown. This year feedback is being expanded to cover most of the subjects taught and as many course units as possible.

6. *With regard to cost:*
   Instructional television, as everybody knows, is not a shoestring proposition of hiring a few people and spending a few thousand dollars per year. This year the administration and production staff consists of 160 people, and expenditures amount to nearly half a million dollars. People tend to be awed by such a sum, but it has to be looked at in perspective. Compared with a total education budget of $25 million, instructional television amounts to 2 percent of the total.

The question is what will happen to the bill when broadcasting is extended to the first six grades of primary school enrolling 93 percent of the pupils. Will costs rise sky high?

One economist believes that after the enterprise gets going and is geared up to a minimum critical size, further expansion can take place with minor additional costs. He found that in 1971, for example, El Salvador is adding one new grade, the ninth, to instructional television; is revising more than 50 percent of last year's eighth-grade and 20 percent of the seventh-grade televised lessons; in addition, there are substantial teacher training activities. But the television budget has risen only $60,000 and only 20 new people have been added. Projecting this annual increase to six new grades by 1978, our economist estimates a television operating budget of about $900,000 a year compared with a school budget of $36 million or a net of 2 to 3 percent.

These figures make no allowance for efficiencies that will occur as the production team gains experience; as administrative cost is distributed over a large number of students; and as the tasks shift from entirely new programs to revising and updating the videotape inventory.

On the other hand, there will be capital costs and teacher retraining. New and cheaper teacher retraining programs will be required, however, inasmuch as for 250 teachers this year the cost was $1,200 per teacher. The country could not afford such a cost level for 14,000 primary school teachers.

The key point is that low cost alone does not make instructional technology cheap. But if the learning effectiveness of television can be firmly established and the level of instruction improved, television has the makings of becoming a great educational bargain.

Some important ingredients went into the Salvador project, including:

1. Revising the curriculum to include up-to-date subject matter and concepts relevant to Salvador's young people;
2. Retraining the teachers to use new teaching methods, to handle the subject matter, and to work with television;
3. Programming adequately—producing some 500 20-minute television programs a year for each grade involved;
4. Producing and promptly delivering a series of weekly workbooks for the students tied directly into the TV lessons;
5. Preparing delivery of a series of guidebooks for the teachers also tied directly to the TV lessons; and
6. Developing a test and evaluation program which started prior to the first broadcast lesson with a series of pre-television tests and functioned continually during the year.

NIGER

Another project which the Academy looked at during preparation of the handbook was the educational television pilot project in Niger, a small, dry, landlocked country in northwest Africa. The Niger project was planned in 1963 and began operation in 1964. Today the educational television program has transformed the education of about 800 primary school children in 22 one-room schools near Niamey, the capital. However, it is still a pilot project. Originally the program was intended to expand throughout the country, but adequate funds for expansion were never available.

Niger was the first American country to give youngsters complete instruction via TV, and the first to use a classroom monitor to offset the teacher shortage—usually a young man with not more than a sixth-grade education but with general enthusiasm and alertness, a desire to learn, and love for and ability to work with children. After a quick three-month training program, monitors were given guidebooks to go along with the television courses. They prepared the students for the TV lesson, then followed it up and assigned appropriate activities geared to the abilities of the individual pupils in the class.

The Niger TV programs are designed and planned by an international team of educators, media specialists, psychologists, and sociologists. They rely heavily on feedback from the programs that they get from the monitors and the children via a traveling observer who periodically visits each school.

The new system's most important job in the Nigerienne experiment has been to teach the children to communicate in French, the national language. All programs, prepared in French, are designed to present broad ideas and utilize, where possible, objects and knowledge with which the children are already familiar. The TV teacher seldom just delivers a lecture. The emphasis is on games, dramatic sequences, open questions, and problem solving.

In a typical TV classroom in Niger the students sit on clay floors around a TV set. During televised math lessons the children often do their own problems on the floor. After the TV lesson the children work on something related to the lesson.

The schedule of telecasts varies with the age and ability of the students. In general, the younger groups receive fewer programs than the older ones because the directors believe the younger groups need more time for reflection and independent work. A typical schedule for older students includes four 14-minute TV lessons per day, five days per week.

By December 1970, children in the two original experimental classes had had four years of television-based primary school, and pupils in the additional 20 schools three years. Each class has moved up a grade each year, but the number of students receiving television programs remains the same. The two original classes have completed their TV experience.

Although the TV project in Niger is very small (only about 800 out of almost 82,000 primary-school children are involved), its achievement has

been impressive. One measure of its success is the very low failure rate within the TV classes themselves; out of 800 pupils, none failed, while the average rate of repeaters in the traditional classes was about 25 percent. Equally impressive, although unmeasurable, is the effect that television seems to have on the children—called by some a type of "personality explosion."

As for student achievement: 96 percent of the pupils in TV classrooms passed a French language comprehension test after the third year, and 60 percent passed a demanding test in speaking French. Traditional classes made a much poorer showing.

The Nigerienne government has asked that the experiment be extended to the fifth primary year, but so far it has not expanded beyond the 22 schools. No one knows what will happen after October 1972, the date the present experiment is now scheduled to be completed. The reports are that survival, as well as expansion, depends on foreign funding.

AMERICAN SAMOA

American Samoa was the first area of the world to undertake a comprehensive educational reform based on television. American Samoa consists of seven islands in the Pacific south of the equator, with an estimated population in 1970 of 28,000. School attendance is compulsory until pupils complete grade 12 or reach 18 years of age. In 1970, public schools enrolled approximately 10,000 students, and church schools about 1,800.

In 1961 the Governor of Samoa decided to upgrade the educational system of the islands to a level comparable to that of the mainland. The educational problems were those shared by many countries—the Samoan educational system prior to 1961 had no school plant to speak of, no organization, no body of trained teachers nor administrators, no educational goals, and only a limited and not very well defined curriculum. The 43 village elementary schools were rundown. The textbooks used in the schools were produced on the mainland for mainland children, and were somewhat inappropriate for the Samoan child. By comparable American standards, the Samoan teachers averaged not more than a fifth-grade education.

One obvious solution to some of the educational problems in Samoa would have been to import a full corps of teachers from the American mainland. This would have been expensive and would not have contributed adequately to development of the schools because the teachers involved would soon return home. Also, replacing Samoan teachers who were prestigious in the Samoan culture would have disrupted the social, cultural, and economic balance of the islands.

Another possibility would have been to train Samoan teachers in the United States. This would have taken considerable time, and a good group of Samoan teachers would not have been ready to start work back home for nearly ten years. Samoa's immediate educational problems could not wait that long. Therefore, the governor arranged for a small U.S. group of

educators and television specialists to come to the islands in 1967. The team worked out a plan for restructuring the educational system, using television as a core for the program instead of just a supplement. Television would teach the students and at the same time provide the Samoan classroom with additional in-service training. The Samoan classroom teacher and the American television teacher would, in effect, teach together as a team.

In October 1964, the first three TV channels began broadcasting to a few elementary classrooms. A year later three additional channels began broadcasting to secondary schools. The basic curriculum, lesson plans, and student worksheets for most subjects are written by the ETV studio staff. The studio production team produces as many as 200 class programs a week.

English-language proficiency is stressed through the basic curriculum —language arts, mathematics, science, and social studies. A modest amount of time is devoted to vocational programs.

The reports are that the system has been successful in raising the level of English language proficiency and general academic achievement in the primary grades. At the secondary level, however, results are less promising. One main reason seems to be that the majority of current Samoan high school graduates were already at least 13 years old when the new system was initiated. They were not able to adjust quickly enough to both a new curriculum and an entirely new method of teaching. They were caught in the shift from one educational system to another.

The educational system in American Samoa has undergone a major overhaul and redesign during the last decade. The system is moving toward more classroom tacher autonomy and more participation by Samoan staff. U.S. contract TV teachers have been replaced by Samoan TV teachers. There are, presently, nine Samoan TV teachers. The television component is shifting its role from basic prescriptive instruction to one of the media components of a centrally planned, but flexible instructional package. However, the system as it operates today is much more than just television. It includes specially designed schools, teacher supervision, in-service teacher training, and curriculum without rote memorization.

IVORY COAST

The Ivory Coast is just beginning a comprehensive educational reform based on television. In March 1970, representatives of the Ivory Coast, France, and three United Nations agencies formally agreed to collaborate on a ten-year $500 million nationwide classroom television system. For more than four years UNESCO has worked with the Ivory Coast in planning the project. France is expected to provide technical experts; the World Bank is providing some funds for construction of a number of buildings, including a training college for classroom teachers who will supplement the instructional television programs. The bank is also financing a center to produce a French-language instructional program.

This appears to be the world's most ambitious educational TV project

to date. The project will equip primary schools for a million Ivory Coast children with TV sets and build curricula around their use. The plan calls for a television receiver in every grade school classroom in the country by the year 1980. Most teaching will be done via television. In full operation the new educational program is expected to:

- more than double the number of children in primary and secondary schools in the country;
- demonstrate that instructional television can reduce the percentage of school dropouts and grade repeaters when used on a national scale in an underdeveloped country.

The first experimental telecasts began in October 1970; by October 1971, televised classes will be offered to first graders in 600 schools. Many of the TV sets will be battery operated to provide for their use in communities which lack electricity. Ultimately, instruction is to be provided for all pupils in the first four grades.

The use of television is being concentrated in the early grades. UNESCO and French technical experts believe that (a) young children are very receptive to televised teaching, and (b) in the developing countries the teaching of young children is generally inefficient and inordinately expensive.

Television, which in the past has been used only sporadically, will became an essential part of the Ivorian national educational system. Success or failure of the project should have far-reaching implications for other developing countries.

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El Salvador, Niger, American Samoa, and the Ivory Coast are, of course, not the only areas in the developing world that are using technology to advance their educational goals. They are singled out in the handbook because, in their very different ways, they are the most prominent examples of the application of technology as a catalyst for integral reform of education in all its aspects: teaching method, teacher preparation, teaching materials, curriculum revision, independent learning, and research and evaluation. These four examples differ from educational applications of technology in many countries that merely add on devices or media to enrich formal education or, in some instances, to spread its reach without necessarily improving its overall quality or effectiveness.

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So much for the examples. From a broader point of view, as the handbook emphasizes, educational technology is still in a primitive state everywhere in the world. Its history to date has been marked with false starts, inflated expectations, and misunderstandings about its potential and effective use. The development of hardware has far surpassed that of software; media have been added on to existing educational systems. What has been publicized as an exciting and productive experiment frequently turns out to be what one long-time observer calls another "going-to": a project that *is going to* accomplish great educational change *if* it proves out, *if* it is favored by political and educational forces.

Moreover, for those of us who like objective reliability and up-to-date

data, the kind of information we would like to obtain about the use of technology at schools, colleges, and universities is scarce.

It is difficult even for trained investigators to judge the effectiveness of various technological devices after first-hand observation. Data on student achievement are scanty, utilization rates for equipment are mostly unavailable, and costing methods tend to be arbitrary. The accounting figures, if they can be obtained at all, reveal only what money was spent on rather than showing what it was spent to *do*—how much, for example, to teach reading to eight-year olds.

Moreover, to top all of this off, projects that open with a flourish one year disappear from sight a few years later because the funds run out or the political administration changes.

THE FUTURE

Clearly, then, technology's full potential for education belongs to the future; but it is not a science-fiction future any more than it is an overnight magic solution to education's problems. Rather, it is a future that could transform education, not by wishful hopes and dreams, but through long-range, thorough, and systematic planning.

There will be many changes in educational technology and its application within the next decade or two. Experts predict the development of low-cost equipment—transistorized TV sets and inexpensive 8 mm movie cameras and projectors that even a child can operate. Potentially powerful educational tools such as electronic videotape recorders may be used to convert ordinary TV receivers into multi-purpose educational machines.

The most spectacular technological development in the offing for education is, of course, the communications satellite. But its successful educational use will depend inevitably on program content and the way in which satellites are integrated into the whole educational program.

A satellite offers a large country (or group of countries) lacking adequate ground communications a system that can cover a geographic area of a million or more square kilometers. It can broadcast to an entire region or beam its presentations selectively to specific areas for particular users. It can reach isolated and widely scattered populations with an ease and total cost comparable to that involved in teaching dense groupings of people. Unobstructed by mountains, rivers, and other geographical barriers, it has easy access to regions that would be difficult or expensive to reach by ground system.

The cost of operating communications satellites for education are so high that they can be utilized effectively only on a very large scale where the cost of the transmission hardware is a relatively small part of the overall budget.

Today the reports are that India and Brazil are ahead of other nations in plans to use space technology for education. But Mexico, Indonesia, and several African nations are interested.

The proposed Indian satellite experiment, scheduled to begin around 1974 or 1975 could dramatically prove the practical value of the satellite.

India will be the first country to broadcast television programs from a satellite directly into small, inexpensive televisions in remote areas.

Instructional television will be beamed directly to individual TVs in some 2,500 Indian villages. In addition, larger Indian cities will receive the TV signals through large receivers and transmit them to their surrounding populations. India will prepare programs emphasizing family planning, agricultural development, hygiene, and the rudiments of an elementary-school curriculum.

If a one-year experiment with a borrowed U.S. satellite proves successful, India hopes to establish her own satellite communications system to reach 560,000 villages by the year 1985.

Reports are that Brazil's prime interest in using the satellite is to upgrade teacher and student education. Brazil is exploring the possibility of a system designed to broadcast to 150,000 schools and other receiving stations.

The communications satellite, in all its costly glamour and immense versatility dramatizes an essential, basic fact which cannot be stressed too often and which we hope the handbook will help to document. That is: Just as educational technology must be integrated into overall educational reform to be fully effective, so educational planning to be successful must be part of a wider national planning system.

Planning for an educational improvement must proceed hand in hand with systematic planning for housing and employment, for roads and communications, for industry, farming, and trade. Technology can be a powerful tool in improving education, but the lead time is long. Now is the time to begin planning any new educational system that is expected to be in operation five or ten years hence.

SUMMARY AND CONCLUSION

The use of technology to improve education is a development that spread rapidly throughout the world during the decade of the sixties. However, most educational technology projects involve television, "added-on" or "in addition to" existing educational programs.

A few small countries are beginning to use technology as a device to remake and reform their entire educational systems. If they succeed (there is reason to believe that they will) and their experiences are documented with large-scale research and development leading to new insights into learning theory and particularly how people learn, the way may be pointed to dramatic improvements in educational achievement.

There are two attachments to this paper. The first, Attachment A, relates to a new use of educational technology in the United States. The second, Attachment B, refers to a new development in the United States which may have an important bearing on the use and expansion of educational technology throughout the world in the foreseeable future.

Attachment A.

The "Sesame Street" television program is a notable new achievement in the use of educational technology which lies outside the formal school system in the United States. "Sesame Street" is broadcast every day on more than 200 educational television stations. It is designed for pre-school children three to five years old, using the fast-paced plan of action common to U.S. television commercials and bringing instruction directly into the home. Schools are not involved.

The program has a daily audience of 8 million children, is in the process of being expanded, and may have world wide implications before the current development phase of its activities have been completed.

"Sesame Street" concentrates instruction on basic concepts such as numbers, alphabet, and simple words and phrases. Entertainment is interspersed with songs and games in order to make learning enjoyable.

Evaluation reports say that children who watch the program regularly show greater gains in learning than those who do not. The reports also claim that because of the large audiences involved in the production programming expenditures amount to no more than 70 cents per year per child watching the program.

As a result of its great success, "Sesame Street" is planning to start a new series of television programs in October 1971 aimed at seven-to-ten-year-old children who have reading difficulties. One hundred thirty half-hour programs will be broadcast on a schedule of five days a week for 26 weeks.

Programs will be broadcast mainly in the late afternoon directly into the home in order to provide an extra reading opportunity. However, many stations expect schools in their areas to request that programs be broadcast during school hours as part of a regular in-school reading improvement service.

Attachment B.

The proposed establishment of a National Institute of Education is a new development in the United States which may have an important bearing on the use and expansion of educational technology throughout the world in the foreseeable future.

A few years ago the U.S. Commissioner of Education established a national Commission on Instructional Technology in the belief that technology properly supported and wisely used could help meet some of the nations most pressing educational needs. The Commission's task was to determine whether this belief in technology's value for education was justified and, if so, to recommend specific actions for the most effective possible application of technology to education.

The Commission found, as might have been expected, that technology was touching only a fraction of instruction in American schools, colleges, and universities. The results were varied, with some institutions making a creative and sustained use of the new media and others quickly lost interest after an initial burst of enthusiasm.

The Commission then went on to say in its report that it believed that

technology could make education more productive, individual, and powerful; make learning more immediate, and give instruction a more scientific base. The Commission concluded that the nation should increase its investment in educational technology. But it then went on to say that technology could carry out its full potential only if educators embraced technology as a system, and integrated a range of human and nonhuman resources into the total educational process.

In order to be able to achieve such improvements the knowledge of how people learn must be deepened and the capacity to put that knowledge to effective use must be increased. To do this, the Commission proposed the establishment near the top level of government of a new National Institute of Education. This organization would conduct research and make grants to universities and other independent groups to conduct research, carry on development and apply the research findings in demonstration projects to improve education.

The NIE would be expected to work on the big problems facing education. It would, for example, do it itself or support research into the learning process in all its sociological, psychological and physiological variables. There would be short range studies designed to change educational practice immediately; and long range studies which might not change practice for some time. For example, there might be studies on the effects of chemical stimulation upon learning at the same time as there were studies on how to utilize new procedures or processes effectively.

The Commission also proposed the establishment of a number of subsidiary institutes, including a National Institute of Instructional Technology, whose chief function would be to encourage the production of a wide variety of instructional materials using the new technology. The Institute would be a mechanism which could bring education and industry together in a close working relationship to advance the effectiveness of instruction to the application of technology.

Legislation on the National Institute idea is now before Congress and is expected to be enacted this year.

APPENDIX II

EDUCATIONAL TV VIA SATELLITE IN ARGENTINA: SOME BRIEF COMMENTS

By Conrado J. Estol

The National Commission for Space Research (Comisión Nacional de Investigaciones Espaciales—CNIE) is the national agency charged with the promotion and coordination of space related activities in Argentina. In the last few years CNIE has been taking special interest in all space activities with a potential practical benefit for the welfare of the country. This is the case for instance, in the programs it has undertaken in the study of remote sensing of natural resources from aircraft, balloons, sounding rockets and satellites; hail control by means of small rockets; and, of particular interest to our case, educational television via satellite. CNIE created some time ago a specialized committee charged with the task of studying the problem and advising on the best approach leading to the eventual implementation of a national or regional system of that type.

A similar body has been created within the sphere of the Ministry of Culture of Education, with members from different agencies of the Argentine government.

To give a proper perspective to these brief comments, we could start by mentioning a few quantitative facts about Argentina. The country has a population of about 23 million people in a continent area of slightly over one million square miles. In 1971, enrollment in primary education reached 3,967,000; in the secondary level it was 444,400; and in the higher level it was 286,800. It is very interesting to notice the problem of population distribution; for instance, about one third of the total population lives in the area of the Greater Buenos Aires.

An official Argentine government study has provided a considerable amount of data on the Argentine educational system and has also pointed out different factors which are to blame for the inefficiency of the system. Among them we can mention the following:

1) The complexity and lack of coordination of the educational structure.
2) The lack of facilities and inefficient use of those that are available.
3) The high drop-out rate.

The different schooling rates in 1967 were as follows: Primary level: 92.6%, secondary: 28.4% and higher (university) 7.2%. These rates seem quite adequate; they obscure, however, a rather high level of quantitative inefficiency. To give an example, only slightly more than half of the children entering the primary level finish the seven year schooling level (58.3% for the years 1965-1966); there is also a rather high repetition rate (25% for the first year in school and 15% for the second year).

In short, the fundamental problems of the educational system seem to be the high drop-out and repetition rates and the excessive length of time taken by students to finish the required schooling.

Even more, a detailed study of the available data brings out the problem of the inequality of educational opportunities. There are significant differences in the educational situation of different regions of the country with respect to the national average. In general, only in the Greater Buenos Aires area, and in the Provinces of Córdoba, Santa Fé and Mendoza, the educational situation approximates, or is better, than the national average. These differences can best be indicated by the drop-out rate in the primary schooling level. In 1965-66 that rate was about 42 percent for the country as a whole; nevertheless, in the Province of Neuquén it reached 82%; in Corrientes, 73%; in Chaco, 72%; in Formosa, 69%; in Misiones, 68%; in Santiago del Estero, 65%; and in Rio Negro and Jujuy, 64%.

The situation is such that one can think that the present system could greatly benefit from the use of modern educational technology (any changes would of course have to be taken in the context of the country's general situation and taking into account the need to study many different problems, from teacher salaries to class-room or school physical improvements). In particular the idea has been set forth that television could very well provide the means to improve the level of teaching, motivate the student body and in general increase the system's efficiency. In this regard, if the assumption is accepted that a national TV educational system should provide equal opportunities to *every* citizen in the country, then a *satellite* system becomes highly cost-effective and provides the best answer to the problem.

The Argentine National Commission for Space Research some time ago made a study—which I directed—concerning this type of system; the general results of that study, including background information on other studies made elsewhere, are included in "Televisión Educativa Vía Satélite", a two volume publication in Spanish.

Finally, it is important to mention that although there is no whole-scale TV educational program in Argentina, there exists experience in the production of rather successful radio and TV educational programs on a limited basis. Among the TV educational programs, one could mention "Telescuela Primaria", consisting of one-half hour daily programs broadcast over commercial channels, and "Telescuela Técnica", with several courses of a technical nature broadcast over different channels in Buenos Aires and other cities.